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ABSTRACT

One hundred freshmen students at the University of Missouri-Kansas City (UMKC) School of Medicine were surveyed using the Lancaster Approaches to Studying Inventory to determine if the success of students at a highly selective combined baccalaureate/MD degree program is affected by their different approaches to learning. Analysis of the survey results indicated that the learning styles of students from this combined-degree school tend to be similar to the learning styles of students from other baccalaureate degree programs in medicine. It appeared that there were some relationships between approaches to learning and success in the program, and that this association between learning styles and success was related to gender differences. Among the implications presented was the observation that if learning styles are consistently related to student success at the subject, semester, or program level, then the results must be discussed with students so they can succeed in the program. Contains 21 references. (GLR)

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Approaches to Learning by Undergraduate Students:
A Longitudinal Study

Authors:

Julia M. Duckwall
Director, Institutional Research
Shelby State Community College
P.O. Box 40568
Memphis, Tennessee 38174

(901) 528-6830

Louise Arnold
Professor and Director
Medical Education and Research
University of Missouri-Kansas City
2411 Holmes
Kansas City, Missouri 64108

(816) 276-1840

Jeannie Hayes
Graduate Research Assistant
Medical Education and Research
University of Missouri-Kansas City
2411 Holmes
Kansas City, Missouri 64108

(816) 276-1888

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Jean Endo
Chair and Editor
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Advisory Committee

Approaches to Learning by Undergraduate Students:

A Longitudinal Study

Abstract

The purpose of this study was to determine if the success of students at a highly selective combined baccalaureate/MD degree program is affected by their different approaches to learning. One hundred freshmen students at the University of Missouri-Kansas City School of Medicine (UMKC) were surveyed using the Lancaster Approaches to Studying Inventory (short survey by Entwistle, 1981). Analysis of the data indicates that the learning styles of students from this combined degree school tend to be similar to the learning styles of students from other baccalaureate degree programs in medicine. It appears there are some relationships between approaches to learning and success in the program. This association between learning styles and success also appears to be related to gender differences.

Introduction

A particularly intriguing question for educators is why students with documented similar academic abilities at one level do not perform similarly at the next level. This is especially important in any selective school where the students are admitted in part for their academic ability and where all students are deemed capable of success in the program. One possible explanation is that the learning style of the student is not matched to the educational task. It is of interest to educators not only to identify those different approaches to learning but also to eventually try to affect a change in those students whose learning styles are not bringing them success.

Purpose

The purpose of this study was to determine if the success of students in the highly selective combined baccalaureate/MD degree program at the University of Missouri-Kansas City School of Medicine (UMKC) is affected by their different approaches to learning. The researchers have noted in the past that a student may excel in one required science course yet find another difficult. Of particular interest to the authors is whether student success in selected scientific disciplines is affected by different approaches to learning. Because prior research at this institution has shown a relationship between gender and performance, it was also of interest to determine if the approaches to learning were associated with gender and if the relationship between success and learning styles is gender dependent.

Review of Literature

At the present, there is an abundance of published information regarding theories of learning, spanning a number of disciplines, and varying somewhat within disciplines. Keefe (1987) offers a comprehensive definition, pointing to three different aspects of learning styles:

Learning styles are characteristic cognitive, affective, and psychological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1987, p. 16).

A number of studies have documented the effect psychological and affective aspects have on individual learning styles (Barbe and Milone, 1980; Semple, 1982). To be sure, this body of knowledge has contributed tremendously to our understanding of the learning process. Increasingly, more recent studies are focusing on the cognitive aspect of learning.

Regarding the cognitive domain specifically, a number of perspectives have been advanced, differing according to the theoretical base. One approach from cognitive and perception psychology envisions learning styles as cognitive personality, where the focus is on basic learning processes or stable and fundamental individual characteristics of perceiving, remembering, thinking, or problem solving. The work of Witkin (1971, 1977), Goodenough (1979), and others exemplify this approach. Cognitive styles are seen as characteristic, self-consistent modes of functioning that individuals exhibit in their perceptual and

intellectual activities (Witkin, et al., 1971). One dimension of cognitive styles concerns field-independence/dependence, relating to form rather than content of cognitive activity (Witkin, et al., 1977). Peplin and colleagues have explored the possibility that field dependence might be influenced by sex differences (Peplin and Larsen, 1989).

A second approach to understanding learning styles focuses on how an individual processes information. More specifically, this approach considers the individual's typical style of acquiring and using information in learning and/or solving problems. The work of Kolb (1976, 1979), based on the educational theory of Dewey and often used in medical education, exemplifies this approach. Case Western Reserve University School of Medicine has used this approach and its companion Learning Style Inventory (Wentz, et al., 1986). More recently, Magolda (1989) also has used this approach in her research on gender differences in cognitive development.

A third perspective centers around instructional preferences. Developed by educationalists, this approach examines more directly learning experiences within the everyday learning environment. The work of Rezler (1981) illustrates this approach.

A fourth approach, which has proven useful in medical education, utilizes the Lancaster Inventory of Approaches to Learning (1977). More recently, Entwistle modified the Lancaster Inventory and developed the Short Inventory of Approaches to Learning (1981). This Short Inventory has been administered by researchers in Europe, the United Kingdom, and Australia (Coles, 1985; Chessell, 1986; Martenson, 1986; Newble and Gordon, 1985).

Their findings have been well received by educators and have stimulated further research in medical education as well as other academic disciplines (Ramsden, et al., 1988; De Volder and De Grave, 1989; Gledhill and Van Der Merwe, 1989; Van Langenberghe, 1988). Perhaps the increasing popularity of this approach stems from its bridging of both the information-processing and instructional preference approaches to learning. Indeed, it goes beyond these two cognitive approaches and draws upon the affective aspect of learning style as it includes concepts such as motivation and intent as integral elements. It is this last approach that the authors have adopted for this paper.

Data Sources

The University of Missouri-Kansas City School of Medicine (UMKC) offers a combined baccalaureate/MD degree program that selects qualified students out of high school. The curriculum integrates clinical and basic sciences, social sciences, and humanities while stressing problem-solving throughout the six-year program. This study follows the 100-student entering freshman class of Fall, 1988, through the first semester of their sophomore year.

Methodology

The students were surveyed using the Lancaster Approaches to Studying Inventory (short survey by Entwistle, 1981). This inventory characterizes approaches to learning along eight dimensions: achievement-motivation (well-organized study methods, competitiveness, and strategic approach); reproducing orientation

(surface approach, extrinsic motivation, and syllabus-boundness); meaning orientation (deep approach and intrinsic motivation); comprehension learning (comprehension and globetrotting); operation learning (logic and improvidence); versatile style (a combination of meaning, comprehension, and detailed learning); pathological style (a combination of poor study approaches); and prediction of study success (a combination of versatile style and well-organized study habits without any of the poor study approaches). The inventory was administered to the students at the beginning of the first and second semesters of both their freshman and sophomore years.

If different learning styles prove more effective for different subjects, success in different required college science courses might be related to the learning style of the student. Success in these required courses is necessary for overall success in the program in that a student must pass the initial course in a given subject area to enroll in the next higher level. Further, success in required science courses is necessary for promotion from one year to the next, and ultimately to graduation from the medical program. Success was measured in three ways: the student's grade in selected required college science courses, semester GPA's, and whether the student was on track in the program by the second semester in their sophomore year.

Personal characteristics (sex and race) and admission information (percentile rank in high school graduating class, percentile on the ACT, hours in high school sciences, and parent's education) completed the database.

In order to test the strength of the relationships between

learning styles and success, Student's t-tests and multiple regression analysis were used. Stepwise method of entry of variables was used in some instances to determine the variables for the regression model. Forward entry was used to test those variables of interest in the regression model after the other variables were entered. Because of the number of Student's t-tests and multiple regression analyses necessary, there was a possibility that false-positive errors would be introduced. Thus, a more conservative observed significance level ($p=0.01$) was used to test all relationships statistically. The change in variance (ΔR^2 , the square of the part correlation coefficient) was also considered to determine the practical importance of the addition of one of the variables to the regression model, controlling for the others.

Results

The 100 students in UMKC's Year 1 class are typical of most of the School's recent freshmen classes. Two-thirds of the freshmen were in the top five percent of their high school graduating class and over three-quarters of the class scored in at least the 90th percentile on the ACT. While in high school, 52 students had at least four semesters of biology and 36 had at least 36 hours of chemistry. All students had at least two semesters of both biology and chemistry. Mothers of 63 students and fathers of 83 students had at least a four-year college degree. (Table 1 further describes this class).

The first Study Inventory, administered in September, 1988, was completed by 94 freshmen. The second inventory was

administered in January, 1989, and 96 of 98 students completed it. The third inventory, administered in September, 1989, produced 92 usable surveys. The fourth inventory, administered in January, 1990, produced 94 usable surveys (Table 1).

School-to-School Comparisons. The learning styles of students from UMKC's combined degree program tend to be similar to the learning styles of students from other baccalaureate degree programs in medicine along selected dimensions of the Lancaster Inventory (Coles, 1985; Martenson, 1986). On entry, the mean scores of students from UMKC are more similar to the mean scores of students in conventional British schools of medicine on the dimensions of reproducing orientation, meaning orientation, pathological style, and versatile style, and to the mean scores of students in a problem-based European school and the Karolinska Institutet (an integrated medical program in Sweden) on the prediction of study success. The students at UMKC tend to follow the trends over time of both the conventional and problem-based medical schools in that their mean scores decreased on the dimensions of achievement-motivation, meaning orientation, versatile style, and study success, and increased on the dimensions of reproducing orientation and pathological style.

Longitudinal Correlations of Inventory Instrument. Product-moment correlations were observed to determine the stability of selected dimensions over time (Table 2). All of the comparisons were statistically significant (1-tailed, $p=0.001$). The highest correlations were between the September, 1989, and the January, 1990, administrations for the dimensions of achievement-motivation

($r=.6502$), versatile style ($r=.7696$), pathological style ($r=.6568$), and study success ($r=.7468$).

Success. It appears there are some relationships between approaches to learning and success in the combined degree program. In this study, success was measured in three ways: the student's grade in selected required science courses, semester GPA's, and whether the student was on track in the program by the second semester in their sophomore year.

A regression analysis of students' grades in required college science courses indicate that several dimensions of the Lancaster Inventory are related to some of the course grades (Table 3). Overall prediction of study success was entered into each regression equation after controlling for the other significant variables, and the overall model was significant ($p=.001$) for four of the required college science courses. The dimension of achievement-motivation was entered into each regression equation after controlling for the other significant variables, and the overall model was significant ($p=.001$) for two of the courses. Change in variance (ΔR^2) also was noted to see if study success or achievement-motivation added enough explained variance to the model to be practically important. The only model, to which the addition of achievement-motivation is statistically significant ($p=.001$) and practically important ($\Delta R^2=0.116$), is the regression equation for success in Microbiology 121.

A regression analysis of students' GPA for each semester indicate that several dimensions of the Lancaster Inventory are related to some of the semester GPA's (Table 4). Overall prediction of study success was entered into each regression

equation after controlling for the other significant variables, and the overall model was significant ($p=.001$) for one of the semester GPA's. Next, the dimension of achievement-motivation was entered into each regression equation after controlling for all the other significant variables, and the overall model was significant ($p=.001$) for two of the semester GPA's. Change in variance (ΔR^2) also was noted to see if study success or achievement-motivation added enough explained variance to the model to be practically important. The only model, to which the addition of achievement-motivation is statistically significant ($p=.001$) and practically important ($\Delta R^2=0.074$), is the regression equation for GPA, Spring, 1989.

To look at success in terms of whether students were on track, Student's t-tests were performed to test the means of the two groups (on track and off track students) for the selected dimensions study success, achievement-motivation, and comprehension learning of the Lancaster Inventory (Table 5). The two groups appear to differ significantly ($p=.01$) only on their mean scores along the dimension of comprehension learning on the first administration of the inventory.

Gender. The association between learning styles and success was tested to determine if there were gender differences. On all four administrations of the inventory, women tend to have a higher score than men on the more negative dimension of pathological style and a lower score than men on versatile style and prediction of study success (Table 6). These differences were tested using Student's t-tests but none of the differences were statistically

significant ($p=.01$).

Men tend to get higher grades in the required college science courses (Table 7). These differences were again tested, and although F-tests indicated that the variance of the two groups (men and women) were statistically different for Chemistry 211 ($p=.01$) and Biochemistry 365 ($p=.01$), Student's t-tests did not indicate any statistical differences ($p=.01$). A greater percentage of men (90%) tended to be on track than women (82%) by the second semester of the sophomore year but a chi-square test indicated this difference was not significant ($p=.01$).

Conclusions

Analysis of the data indicates that the learning styles of students from this combined degree school tend to be similar to the learning styles of students from other baccalaureate degree programs in medicine along selected dimensions of the Lancaster Inventory. It also appears that there are some relationships between approaches to learning and success in the combined degree program, measured by the student's grade in selected required science courses, semester GPA's, and whether the student was on track in the program by the second semester in their sophomore year.

Achievement-motivation is the dimension that seems to provide the most information, in terms of student success defined by course grades and GPA, during the first two years of undergraduate education at UMKC School of Medicine. This dimension is a combination of well-organized study methods, competitiveness, and a strategic approach to learning that indicates an ability of the

student to adapt to the situation. It is not surprising that students need these characteristics in this accelerated program to complete the demanding curriculum.

The dimension of comprehension learning may be the best indicator of those students who will be on track and those who will not be on track one-and-one-half years into the program. Those who are not on track tend to have a higher score on this dimension, perhaps due to the influence of globetrotting in this scale.

Finally, while there appear to be some gender differences related to student success, none of the differences in means are statistically significant in the current models.

Implications

The relationships noted as fairly stable through time will require further investigation as this cohort group is followed for the next several years. It will be particularly interesting to note whether students adapt their learning styles to changes in educational task. UMKC School of Medicine students move from a predominately arts and sciences course load in the first two years of their program to an increasingly clinical emphasis in the last four years of their training. As students move out of a classroom situation that favors well-organized study methods and competitiveness and into the clinical setting that favors intrinsic motivation and a deeper learning approach, the dimension of achievement-motivation may become less important while the dimension of meaning orientation may become more predictive. Also, as students fail to be promoted to Year 3 of the program, it

will be of interest to see if the dimension comprehension learning continues to discriminate between those students who are on track and those who are not.

If learning styles are consistently related to student success at the subject, semester, or program level, then the results must be discussed with students so they can succeed in the program. Given the freshman and sophomore levels of students studied, these results may also have academic implications for educators in a wide variety of postsecondary institutions.

Table 1. Characteristics of Freshmen, 1988, Students Enrolled at
University of Missouri-Kansas City School of Medicine

	Fall, '88	Spring, '89	Fall, '89	Spring, '90
Usable inventories	94	96	92	94
N enrolled	100	98	97	96
Women	51	50	49	48
Men	49	48	48	48
Black	4	4	4	4
Hispanic	1	0	0	0
Asian-American	39	39	39	39
White	56	55	54	53
On track	100	99	86	86
Women	51	50	42	42
Men	49	49	44	44
Mean GPA	3.36	3.20	3.36	

Table 2. Product-moment Correlations of Selected Dimensions of the Lancaster Approaches to Studying Inventory over Time

Achievement*			
	Entry	Year 0.5	Year 1.0
Year 0.5	.4441		
Year 1.0	.3916	.5201	
Year 1.5	.4195	.5290	.6502

Versatile Style*			
	Entry	Year 0.5	Year 1.0
Year 0.5	.5480		
Year 1.0	.5149	.5465	
Year 1.5	.5414	.5393	.7696

Pathological Style*			
	Entry	Year 0.5	Year 1.0
Year 0.5	.5744		
Year 1.0	.5857	.6464	
Year 1.5	.4618	.5915	.6568

Study Success*			
	Entry	Year 0.5	Year 1.0
Year 0.5	.6173		
Year 1.0	.6443	.6484	
Year 1.5	.6445	.6526	.7468

*All pairs are significant (1-tailed) at $p=0.001$

Table 3. Regression Analysis of Grades in Selected Required College Science Courses

		Variables			Total
	Sig. F	In Model	T Sig.	ΔR^2	R^2
Chemistry 211	.000	Rank	.007		
		HS Physics Hrs.	.007		
		Study Success 1	.203	.007	.215
Anatomy 119	.000	Rank	.000		
		HS Biology Hrs.	.054		
		Study Success 2	.032	.033	.207
Microbiology 121	.001	Rank	.005		
		HS Physics Hrs.	.090		
		Study Success 2	.016	.048	.147
Organic Chem. 320	.000	Rank	.001		
		HS Physics Hrs.	.031		
		Dad Educ.	.021		
		Study Success 2	.078	.020	.211
Chemistry 211	.000	Rank	.001		
		HS Physics Hrs.	.001		
		Achievement 1	.010	.057	.265
Anatomy 119	.000	Rank	.000		
		HS Biology Hrs.	.059		
		Achievement 2	.010	.051	.221
Microbiology 121	.000	Rank	.006		
		HS Physics Hrs.	.051		
		Achievement 2	.000	.126	.225

Table 4. Regression Analysis of College Semester GPA's

	Variables			Total	
	Sig. F	In Model	T Sig.	ΔR^2	R^2
GPA, Spg., 1989	.000	Rank	.000		
		HS Physics Hrs.	.055		
		Study Success 2	.012	.036	.203
GPA, Spg., 1989	.000	Rank	.001		
		HS Physics Hrs.	.030		
		Achievement 2	.001	.074	.240
GPA, Fall, 1989	.002	Rank	.010		
		HS Physics Hrs.	.037		
		Achievement 3	.196	.008	.143

Table 5. Comparison of Means between Students On Track and Not On Track for Selected Dimensions of the Lancaster Approaches to Studying Inventory: Study Success, Achievement, and Comprehension

	Means		F-value	Sig.	T-value	Sig.
	On track	Off track				
Success 1	76.93	76.29	1.41	.498	0.23	.820
Achieve 1	17.74	16.50	1.23	.552	1.42	.175
Compreh 1	13.32	15.71	1.87	.209	-3.11	.005
Success 2	75.82	71.00	1.27	.526	1.24	.240
Achieve 2	16.72	15.91	1.09	.759	0.76	.461
Compreh 2	13.09	15.27	2.46	.025	-1.65	.127
Success 3	74.00	74.45	1.10	.939	0.12	.907
Achieve 3	15.98	15.82	1.03	.844	0.13	.899
Compreh 3	12.98	15.09	1.89	.116	-1.75	.108
Success 4	74.02	70.36	1.41	.578	1.08	.300
Achieve 4	16.52	17.00	1.27	.526	-0.42	.684
Compreh 4	13.06	15.09	1.22	.578	-2.25	.044

Table 6. Comparison of Means between Women and Men on Selected Dimensions of the Lancaster Approaches to Studying Inventory: Versatile Style, Pathological Style, and Study Success

	Means					
Versatile Style	Women	Men	F-value	Sig.	T-Test	Sig.
Fall, '88	33.54	34.08	1.71	.074	-0.42	.673
Spg., '89	32.06	34.21	1.42	.234	-1.32	.190
Fall, '89	32.28	34.13	1.38	.279	-1.37	.174
Spg., '90	32.00	34.04	1.18	.564	-1.62	.109
Pathologic Style						
Fall, '88	23.04	22.06	1.22	.502	0.73	.466
Spg., '89	23.48	22.04	1.18	.567	1.08	.285
Fall, '89	24.04	22.04	1.10	.745	1.37	.174
Spg., '90	25.04	22.91	1.22	.507	1.47	.145
Success						
Fall, '88	76.09	77.54	1.18	.579	-0.65	.515
Spg., '89	73.38	77.17	1.15	.638	-1.68	.096
Fall, '89	72.22	75.89	1.31	.362	-1.44	.153
Spg., '90	71.58	75.70	1.13	.684	-1.67	.098

Table 7. Comparison of Means between Women and Men on Grades in Selected Required College Science Courses and on Semester GPA's

	Means*		Standard Dev.		F-Test	T-Test
	Women	Men	Women	Men	Sig.	Sig.
Chemistry 211	3.77	3.77	1.18	0.78	.499	.147
Chemistry 212	3.91	4.00	0.87	0.93	.265	.576
Anatomy 119	4.51	4.55	0.61	0.61	.979	.738
Microbiology 121	4.22	4.35	0.82	0.67	.095	.322
Organic Chem 320	4.20	4.23	0.75	0.86	.368	.840
Biochemistry 365	3.83	3.89	0.70	1.05	.012	.756
GPA, Fall, 1988	3.329	3.344	0.54	0.51	.734	.884
GPA, Spg., 1989	3.157	3.251	0.87	0.74	.279	.557
GPA, Sum., 1989	3.290	3.363	0.58	0.72	.160	.589
GPA, Fall, 1989	3.345	3.403	0.47	0.46	.893	.537

*Means for courses based on A=5; Means for GPA's based on 4.00

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